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EDITORIAL NOTES

NATIONAL FUEL ADVISORY COUNCIL

IT is now understood that the Minister of Fuel and Power has decided to set up a National Fuel Advisory Council. While the Gas Industry most certainly would not claim credit for having initiated in the mind of the Minister the taking of so obvious a step, it can at least find satisfaction in the knowledge that it has long advocated such a policy—Sir David Milne-Watson, Dr. E. W. Smith, and others having on many occasions stressed the urgency of a genuine national fuel policy. Such a Council, too, was a featured recommendation of the Planning Report—an item in that much discussed document which we believe has found favour with all sectional interests in the Industry, whatever objections they may have had to other proposals. It was a point in the Report, too, which caught the public's imagination and received favourable comment in the Press. In it, perhaps, the ordinary man sees hope of certain of his fuel questions being answered for him by a Council of experts instead of his having to decide for himself which are the least credible among rival sets of garrulous salesmen who seek his custom for various industries. On this matter of competition we have had much to say in recent issues, especially in view of expressions of opinion by the electricity industry, or at least powerful sections of it, that free-for-all competition should be allowed to decide the fate of the nation's fuel resources. Gas will be ready enough for the fray if need be, but we consider that influences other than pure commercial combat should be given reasonable scope.

We know no details of the Minister's proposals in this direction; as likely as not they are still in process of formulation. It is a development, however, which the Gas Industry can welcome whole-heartedly, whatever shape it may ultimately assume; one in which it can give all the co-operation which the Ministry will no doubt desire.

A COMMITTEE OF ENQUIRY

ANOTHER item of news from the Ministry which is not in the least surprising, and which should be welcome to all who desire to see an end of biased partisanship and the drag it is imposing on the more serious purposes of the Industry, is that the Minister proposes to appoint a small committee of enquiry. Who can blame him for desiring an expert sifting of the evidence which various parties are clearly clamouring to submit to support their ideas for the future development of the Industry? In effect, there is little else he can do but institute a judicial enquiry, and, so long as it results in the indication of a broad policy to be developed and implemented by the Industry itself with its wealth of practical experience, we shall be content. The immediate task, therefore, is to prepare evidence and, though last-minute attempts to present any sort of united front are a pretty conception, the points which offer any worth while prospect of agreement between sectional interests are, in our opinion, extremely limited. From the point of view of time saving, anything that can be achieved will be welcome, but in the long run peace and unity within the Industry will be best served by encouraging everybody who so desires to have his say.

Personally we should welcome any steps that could be taken to give effective expression to the views of the juniors, which term, in our Industry, implies not only those of tender years, but also men of ripe experience holding important posts in large undertakings. Many of them hold decided opinions which in some cases, though by no means all, might well be tempered by a spell of still higher responsibility. But naturally they have not the same facilities as have others for "organizing" the evidence they certainly desire to offer, and any help and encouragement which could be given them in this respect might well be repaid by valuable contributions to the solution of problems, and most certainly by subsequent contentment due to having received a fair hearing.

We know well from experience, our own and that of other industries, the time occupied by such enquiries until the production of the final report. Let us be quite clear in our minds that to us, as an Industry, this time is not just a heaven-sent breathing space. For example, the buzz of the housing planners is becoming more and more insistent, and housing plans simply cannot wait upon the completion of an enquiry into the affairs (largely internal) of the Gas Industry. B.G.A. or no B.G.A., there are committees admirably serving our interests in matters such as this; to our mind it is a pity either that they may not, or do not, shed more light on their dealings with the endless Ministries which seem concerned. These committees need every possible support both at headquarters and in the districts, and this is only one example of the impossibility of easing up upon any excuse whatever.

THE BRITISH GAS ASSOCIATION

THE B.G.A. is only a means to an end—the better organization of our Industry as a public utility—and the details attending its birth are causing an extravagant amount of distraction from the work which is ahead of us. None the less, while we are about it, it is desirable to make it as strong and as efficient a body as possible, and with this in view there has been intensive study of the draft constitution.

For our part, we must confess to a certain disappointment that it is not possible to make of it an all-embracing gas body—a really workable development of the British Gas Federation conception. However, we have carefully studied the arguments against any such attempt, and we find them unassailable. It is therefore necessary to work for the strongest possible body based upon the gas supply undertakings, which, after all, are the hub about which all the rest revolves.

Without going into too much detail, there are a few points in the draft constitution "before the house" which seem to merit the most careful consideration before any final decision. In the first place, while we agree enthusiastically with the stress laid upon Development, we are frankly a little nervous about the emphasis which the draft places upon the distinction between Central Council and Development Board. The Central Council must clearly be as strong as ever it is possible to fashion it and, democratically elected by the undertakings, it must be assumed that it would consist of those most blessed with vision in regard to development and with capacity to advance it. It is true that they would have the choosing of half the personnel which is to specialize in development but, if the other half of the Board is to be elected direct by the districts, are we not in danger of perpetuating the old system of two distinct bodies, with the dissension and disunity of the past—almost the unseemly wrangling of the last two years or so? We may have misunderstood the exact purport of this dual system of election to the Board; it may be the result of the very proper desire to emphasize the importance of development and make it now absolutely first rank policy. But development of the highest degree will be so dependent upon unity that we are suspicious of anything which might conceivably work in the opposite direction.

The numerical inconsistencies of the proposed systems of

representation were stressed by a correspondent who contributed an analysis to the "JOURNAL" last week. As he himself pointed out to us after publication, his case would have been still stronger had his mathematics not failed him at a critical stage in his calculations. The prospect of a potential assembly of 2,000 people at a general meeting is menacing; even the much more likely 500 at a district meeting is bad enough. But quite apart from this unwieldiness, we can hardly expect the magnanimity of the larger undertakings to be sufficient to accept the proposals as they stand. In any case the municipalities, who would appear to be underweighted in voting rights, would almost certainly claim full weight on the principle that the size of undertakings is more or less proportionate to the number of people served, and that the public must have its rights. Perhaps one of the most telling factors in deciding this particular issue of votes and representation will be the fact that in the end, whatever arguments may be advanced for deciding the basis upon any standard other than the size of undertaking, such variation must apply equally to contributions.

Let us examine the subject from one other angle. While voting rights in the draft constitution bear some kind of relationship, even if not a proportionate one, to the size of undertakings, the unit of personal representation, if we may call it so, is two members per undertaking, whatever its size, on the various District Councils. From the District Councils, as they quite rightly should, all good things proceed upwards to a seat on the Central Council and a direct voice in the shaping of national policy. But, regarding the District Council as the first rung, it would appear that only two members of any undertaking have much prospect of ever setting foot on the ladder. In other words, many able men of high standing will continue, as in the past, to have no chance of pulling any weight outside their own undertaking, even in regard to district affairs, and the Industry will be the loser.

We mention these few points as appearing to require further elucidation. Fortunately the constitution is only in draft, and we shall be surprised if many other comments do not arise for consideration. Above all, we wish to see ever more emphasis laid on the fact that a really strong and united B.G.A. can be built only on the foundation of an effective district organization, London being regarded as the co-ordinating centre for an agreed national policy and not as a directing and ruling force. We are certain, too, that this is the view of those who are carrying the heavy burden of bringing the new Association into being, and that they need every help to bring about the desired consummation.

PLASTICS AND GASMAKING

WE do not know much about plastics, but if we had a little more time on our hands we should like to study the matter of their composition more closely, and try to comprehend at any rate superficially something about the molecular chains and linkages which give to these substances, derived broadly from coal and oil and air and water and cellulose, their remarkable and undoubtedly fascinating properties. We had some enlightenment—sufficient to whet our appetite for more—at a recent meeting of the Eastern District of the Southern Association of Gas Engineers and Managers when Mr. A. Renfrew, Development Manager of I.C.I. (Plastics), Ltd., gave an extraordinarily interesting Paper on the subject in an able manner which was appreciated by everybody at the meeting, and which led to a discussion which evidenced the interest aroused. Our report will appear subsequently. The plastics industry, one of the outstanding developments of recent times, has enjoyed and enjoys a very great deal of publicity—an excess of publicity which may have proved and may prove a source of some embarrassment to those technically and financially engaged in the industry itself, those who know the complications and costs of the processes which make from comparatively simple and inexpensive raw products finished materials of quite remarkable properties. Of course, there would appear to be a tremendous future for the use of plastics, but an element of economic caution would equally appear to be desirable.

Apart from the molecular linkages of the plastic products themselves, there is a definite and positive link between the plastics industry and the Gas Industry. It is, in fact, a two-fold linkage. First, the Gas Industry, through its carbonization process, is an important source of the raw materials—notably benzole and phenol—for plastics; and, secondly, it obviously provides a very great field for the plastics made from its own "by-products." The circle is the reverse of vicious, and it seems to us that its radius could, with mutual understanding between the two industries (one rather old, the other very young, but both very progressive), largely increase. As we have indicated, our knowledge of plastics is negligible, and we were more spellbound than understanding at the meeting when Mr. Renfrew gave his Paper—or, rather, his "talk," for his treatment of the subject was in the nature of a masterly conjuring feat employing a polyglot of chemical terms. Broadly, however, the plastics industry wants from the Gas Industry at one and the same time benzole for its "nylon" group of products and phenols for its polythene, &c., groups. This is, we suggest, somewhat of an incompatible demand. Having in mind the phenols, the Author suggested that the Gas Industry should reduce its temperature of carbonization. If this course was followed, then benzole production would go down proportionately. We think that the solution to the fulfilment of his requirements lies, not in drastic change in carbonizing procedure—and gasmaking has its public obligations—but in extended carbonizing and in much more consideration of the value of the "by-products" of the carbonizing process, and, moreover, the process as a whole. For example, phenol could be recovered from the plants dealing with ammonia liquor. The subject naturally stimulates thought, and to our mind there is no reason to think that while meeting its primary obligations to the community in the ample and economical supply of gaseous and smokeless solid heat, the Gas Industry could not fulfil to a greater measure the growing demands of the plastics industry for raw materials.

The other angle—again a mutual one—is the use of plastics by the Gas Industry, in which regard a knowledge of the properties of plastics—not only of their virtues, but also of their limitations—is needed. Granted this, and granted, too, a sense of economic balance concerning their use in preference to alternative materials, the application of plastics in the Gas Industry would seem exceedingly promising. This application neatly falls into three categories—in plants for the manufacture of gas, in the distribution system, and in installation practice. For instance, the resistance of polythene to chemical action was described by the Author as being "something fantastic," but its temperature resistance is limited to about 70°C.; the protecton of pipelines and metal structures is an application, the possibilities of which spring at once to mind; and equally obvious are the numeous applications to gas fitting and installation work. By selecting the right sort of plastic it should be possible to produce a better-looking article and maybe a more serviceable and even a more economical one. It is a question of fitness for purpose, and the scope does seem very great indeed. The Gas Industry and the plastics industry undoubtedly have interests in common.

Personal

Mr. F. G. SHAW is retiring on superannuation from the post of Engineer and Manager of the Buxton Corporation Gas Department as from June 30 next, after holding the appointment for the past 33 years. He is being retained as Consultant. Mr. Shaw has been very active in Gas Industry affairs. He is a District member of the Institution Education Committee and Chairman of the Lancashire District Gas Education Committee, and also a member of the Gas Engineering Advisory Board, No. 10 Region. In addition he is a member of Committee of the Lancashire Commercial Section, and Vice-Chairman of the Association of Smaller Municipal Gas Undertakings. Mr. Shaw was President of the Manchester District Association of Gas Engineers in 1934.

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Mr. W. S. WATTS, Design Director of Messrs. Bratt Colbran, Ltd., has recently severed his connexion after 16 years with the firm. He intends to continue to devote his experience as a designer to the development of heating appliances. Mr. C. C. PENFOLD, Sales Manager on the gas side, has also resigned after 10 years with the Company. He, too, proposes to continue his interest in the development, manufacture, and marketing of gas appliances.

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Mr. ROBERT WILLIAM YOUNG, F.C.A., a Partner in Messrs. Westcott, Maskell & Company (Chartered Accountants), has been elected a Director of Messrs. William Sugg & Company, Ltd., January 13, 1944.

Obituary

The death has occurred of Mr. PETER BURT, J.P., M.I.E.S., in his 88th year. Mr. Burt was the inventor of the "Acme" wringer and, at the time of his death, Chairman of his firm, Acme Wringers, Ltd. He started making wringers in 1879 in a small factory with only six employees and lived to see his enterprise grow to immense proportions, with the name "Acme" a household word not only in Britain, but in many countries abroad where rubber roller wringers are used. His inventive genius was not confined to wringers, for he also won international fame as the inventor of the single sleeve valve engine, which to-day is proving its worth in our heavy bombers.

Letter to the Editor

Purification and Spent Oxide

DEAR SIR,—The abstract in the Feb. 2 issue of the "GAS JOURNAL" of the Paper entitled "Aids to Purification" by C. Cooper merits careful study by all responsible for the purification of gas.

Reference is made to the importance of controlling the ammonia passing forward to the purifiers and the need for the reduction of the tar fog, if the oxide boxes are to be operated efficiently, and it is with regard to these two constituents that I would like to draw attention in as far as they affect the use of the resultant spent oxide for the production of sulphuric acid.

For some considerable time there has been a noticeable increase of ammonia and tar in spent oxide from many directions. This no doubt results from the additional strain placed on existing wet purification plant by the increased gas makes common to the majority of undertakings, and the difficulty of arranging for the periodical cleaning of Livesey washers, scrubbers, &c., with the labour position as it is to-day. It is therefore not uncommon to be faced with the problem of the disposal of parcels of spent oxide in which the recognized limits of ammonia and tar—viz., 1.0% and 2.0%/2.5% respectively—are appreciably exceeded.

It may not be generally recognized that of the total production of sulphuric acid in this country, only some 15% emanates from spent oxide, so that the acid manufacturers are by no means solely dependent on the gas-works' commodity for their operations. It is true that much more spent oxide is now being consumed by the acid industry, since a serious effort has been made to keep an equitable balance between production and consumption, but it is also true that to meet the extra demand for acid new acid plants have been erected since 1939 which do not use spent oxide. This increased capacity for the production of sulphuric acid from other sulphur-bearing materials should not be overlooked in view of its adverse effect on the demand for spent oxide after the war.

A standard of purity has been established by those acid manufacturers using crude sulphur and other raw materials containing sulphur, which they are naturally desirous of maintaining, and as a number of plants have of recent months been converted for the consumption of spent oxide, there is an insistence that such material shall conform to the generally accepted specification. Spent oxide acid producers have always been up against competition from the purer acid from contact plants, &c., and in this respect were at a disadvantage. Unless the quality of spent oxide is improved it will not be surprising if at the first opportunity there is a reversion to the manufacture of sulphuric acid from materials other than spent oxide on the part of those now having to use it.

Not only, therefore, should the reduction of tar fog in the gas and the control of ammonia receive immediate attention as aids to purification, but also as a means of ensuring that at least it will not be on the score of quality that spent oxide runs the risk of being displaced by other materials for sulphuric acid manufacture when conditions return to normal.

When the ammonia in the gas on the inlet to the purifiers is maintained at 5 grains per 100 cu.ft., a simple calculation will show that the amount present in the oxide worked up to a sulphur content of 50% is of the order of only 0.3/0.5%, thus well within the acid industry's specification for a maximum of 1.0%.

Reference is made in the Paper to a device for controlling the water supply to the final washer according to the composition of the liquor in the last bay, with a compensation for variations in temperature. Further details of this would, we feel sure, be of interest to many for whom the maintenance of a consistent ammonia admission to the purifiers at present constitutes a problem.

An alternative suggestion is to isolate the last bay of the final washer as far as the water circulation is concerned. The main water supply is fed to the last bay but one, and proceeds in contra-flow to the gas in the usual manner. The last bay to which a separate water feed is arranged is for the purpose of removing the remainder of the ammonia from the gas entirely, and the very weak liquor is then drained away, thus avoiding the dilution and consequent increase in volume which would otherwise occur. The admission of the 5 grains of ammonia to the purifiers is accomplished by by-passing the requisite quantity of unstripped gas from the inlet of the washer, this providing a constant proportion, since the by-pass is subject to fluctuations in pressure, temperature, &c., as the main stream.

The British Gas Purifying Materials Co., Ltd.,
99, *London Road*,
Leicester.
Feb. 7, 1944.

Yours faithfully,
E. W. SHARMAN,
Director.

National Fuel Advisory Council

The Minister of Fuel and Power has decided to set up a National Fuel Advisory Council—see editorial comment on p. 207.

Committee of Enquiry

The Minister intends also to appoint a small Committee of Enquiry to hear evidence and to advise him upon the various plans which have been submitted for reorganization of the Gas Industry.

National Gas Council

A Meeting of the Central Executive Board of the National Gas Council was held on Feb. 8 at Gas Industry House. The Chair was taken by Mr. Frank H. Jones (Vice-Chairman).

Before proceedings commenced, the Chairman referred with deep regret to the death of Alderman J. H. Lloyd, who had been a Vice-Chairman of the Board from the year 1931 to 1942.

General Position.—A report on the general coal position was received. Strong protests were lodged against the increase of 3s. per ton on coal as from Feb. 1. It was unanimously resolved that a letter should be sent to the Minister of Fuel and Power on the matter.

Dr. Evans, Chairman of the Gas Advisory Committee to the Ministry of Fuel and Power, reported that as a result of the efforts of the Committee, an Order in Council had now been made which it was hoped would be of assistance to gas undertakings when having to cope with unsuitable coal and shortage of labour. The Order prescribed a method, for the purposes of Section 14 of the Gas Regulation Act, 1934, of averaging the calorific value of the gas (whatever the amount of the deficiency from the declared calorific value) over the quarter in which the deficiency occurred, and either the preceding or the succeeding quarter, or both these quarters.

It was stated that the Association of Tar Distillers had asked the Council to nominate representatives to a Technical Advisory Committee, which the Ministry of Fuel and Power proposed to set up to advise the Government with regard to the working of the Benzole and Coal Spirit Order, and to ensure smooth working with the trade. The nominees of the Benzole Committee were approved.

It was reported that the twelfth annual meeting of the Conjoint Conference of Public Utility Associations had been held on Jan. 26. Lord Falmouth had presided and been re-elected President for the ensuing year. Sir David Milne-Watson and Lord Pentland, representing the gas and electricity interests respectively, had been re-elected Vice-Presidents. The water interests had agreed to nominate a Vice-President to act in the place of the late Sir Francis Fremantle. In his Presidential Address, Lord Falmouth had strongly advocated a policy of co-operation between gas and electricity.

At the meeting of the new Council of the Conference which followed the annual meeting, Mr. A. E. Sylvester had been appointed Chairman of the Council on behalf of the gas interests for the ensuing year, and Mr. H. C. Lamb was appointed Vice-Chairman as representing the electricity interests, Mr. Henry Berry being appointed Vice-Chairman as representing the water interests.

It was reported that, as the result of a request received from the Ministry of Works, the Gas Industry Committee of the British Standards Institution had decided to form a Technical Committee to consider the preparation of British Standards for gas appliances, and had invited each of the three National Bodies to nominate three representatives to act on the Committee in question. It was agreed to accept the invitation, and arrangements were accordingly made for the Council to be represented.

The date of the next meeting was fixed for March 14, at 2 p.m.

The Examinations of The Institution of Gas Engineers in Gas Engineering (Manufacture) will be held on June 3, and in Gas Engineering (Supply) on June 10.

Wandsworth and District Gas Company

The Annual Meeting of the Wandsworth and District Gas Company was held on Feb. 8.

Mr. Frank H. Jones, M.Inst.C.E., Chairman and Managing Director, said that shareholders would be particularly interested to have a little further information regarding the Greater South London Gas Corporation. That Corporation was created to effect the greatest possible efficiency out of the undoubted and available resources of three of the larger gas undertakings in London—namely, the South Metropolitan Gas Company, the South Suburban Gas Company, and the Wandsworth and District Gas Company. Each undertaking would retain its identity and individuality, but, as far as possible, a common policy for the conduct of the undertakings would be recommended.

The Corporation would recommend to the board of each constituent undertaking plans for development which should be most beneficial to the three undertakings considered as one. The policy adopted should be so controlled by co-ordination that the interests of the consumers, the shareholders, and the employees of all constituent undertakings were best served. There was not the slighest doubt that economies and improved working on an important scale would result from the enterprise.

After referring to the appointment as a Director of the Chief Engineer and General Manager, Colonel C. M. Croft, and the casualties among and honours awarded to members of the staff on active service, he went on to say that the Company's ships had continued to run as regularly as conditions permitted. The sales of gas and residual products had been maintained satisfactorily throughout the year under review, but it would be appreciated that it was not possible for him to furnish detailed figures. Despite many difficulties, all the Company's plant, both on the works and in the district, had been maintained at a high standard of efficiency under the prevailing conditions.

In accordance with the policy of the Government, the Company was doing everything possible to further the campaign for fuel economy and, beyond assistance by their staff, their showrooms had been placed at the disposal of the Government and local authorities from time to time to assist them in a very difficult problem. Proprietors would be glad to know that the dividend for 1943 was to be maintained at the same level as that paid in 1942—namely, 5%.

Resolutions were passed approving the proposed dividends, confirming the appointment of Colonel Croft as a Director, and for other formal business.

Diary

Feb. 17.—National Federation of Gas Coke Associations: National Technical Committee, Gas Industry House, 11 a.m.

Feb. 17.—Solid Smokeless Fuels Federation: Technical Committee, Gas Industry House, 2.15 p.m.

Feb. 21.—London and Counties Coke Association: Gas Industry House. Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m.

Feb. 26.—Manchester and District Junior Gas Association, Manchester: Paper on "Benzole Recovery with Activated Carbon," by R. Walker, H. C. Applebee, and A. K. Howell.

Feb. 26.—Yorkshire Junior Gas Association: General Meeting, Rawmarsh.

Feb. 28.—B.C.G.A. Domestic Heat Services Committee, Gas Industry House, 2.30 p.m.

Feb. 29.—Association of Gas Corporations: General Purposes Committee, Gas Industry House, 2.15 p.m.

Mar. 1.—Southern Association (Eastern District): Gas Industry House, 2.30. Discussion to be opened by Mr. C. H. Chester, O.B.E.

Mar. 3.—London and Southern District Junior Gas Association: Gas Industry House.

Mar. 21.—Southern Association: Committee, 11.30 a.m.; Luncheon, 1 p.m.; Annual General Meeting, 2.30 p.m. Holborn Restaurant, W.C. 1. Presidential Address of R. C. Taylor, M.B.E.

Mar. 25.—Western Junior Gas Association, Bristol: Paper on "High Pressure Storage and Distribution," by B. G. Hawkins.

Mar. 29.—London and Southern District Junior Gas Association: Gas Industry House.

Dividends

Cardiff.—For the period ended Dec. 31, 1943, at the usual rates of 2½% on the 4½% Preference Stock (making 4½% for the year) and 3½% on the Consolidated Ordinary Stock (making 6% for the year). Closer co-operation with the Newport Gas Company has been arranged by means of an interchange of Directors, although no form of financial or other integration is contemplated. Mr. G. M. Gill, a Director of the Newport Company, has been appointed to fill the vacancy on the Cardiff Board caused by the death of Mr. B. Turnbull, and Mr. R. J. Auckland, a Cardiff Director, has joined the Newport Board.

Commercial.—The Directors are unable to recommend dividends on the Ordinary or Preference Stocks of the Company for the year ended Dec. 31, 1943.

Croydon.—For the half-year ended Dec. 31, 1943, at the following rates % per annum, less income tax: Preference Stock, 4; Maximum Dividend Stock, 5; Sliding Scale Stock, 6.

Gas Light and Coke.—For the half-year ended Dec. 31, 1943, as follows: On the 3¾% Redeemable Preference Stock, 1970, at the rate of £3 15s.% per annum (dividend paid on Jan. 15); on the 4% Consolidated Preference Stock at the rate of £4% per annum (dividend to be paid on March 1). The payment on April 1 of a dividend for the half-year ended Dec. 31, 1943 on the 3½% Maximum Stock at the rate of £3 10s.% per annum; and the payment on April 1 of a final dividend on the Ordinary Stock of £2 10s.%, making with the interim dividend of £1 10s.% paid on Sept. 1, 1943, a total dividend of £4% for the year 1943. Dividends are in all cases subject to the deduction of income tax.

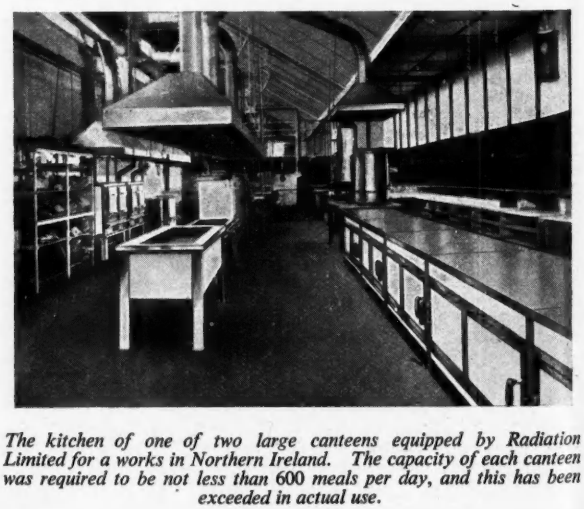
South Metropolitan.—After payment of interest on the Debenture Stocks and full dividends on the Preference Stocks, a dividend of 3% on the Ordinary Stock for the year ended Dec. 31, 1943. (The dividend of 3% on the Ordinary Stock compares with 1% paid last year.)

Watford and St. Albans.—Full final dividends on the Preference Stocks and a Final Dividend of £2 10s.%, making £5% for the year on the Ordinary Stock (all less income tax) in respect of the year ended Dec. 31, 1943. These rates are the same as paid for 1942.

Yorktown (Camberley) and District.—For the half-year ended Dec. 31, 1943: 5% Consolidated Preference Stock £2 10s.% actual (making 5% for the year); 4% Redeemable Preference Stock £2% actual (making 4% for the year); Consolidated Ordinary Stock £2 15s.% actual (making £5 10s.% for the year), all less income tax. The Preference Dividends payable on Feb. 28, the Ordinary Dividend on March 18.

No Fewer than seventeen employees of the Worcester New Gas Light Company have served the Company for more than 40 years, while the Chairman of the Company, Mr. John Stallard, has a record of 63 years' association with the Company as Solicitor, Director, and Chairman. At a meeting a short time ago Mr. G. P. Mitchell, Managing Director and Chief Engineer, remarked how proud he felt to have so many loyal servants round him. He stated that the Chairman had seen the sales of gas rise from approximately 100 to 850 million cu.ft. per annum. Mr. Mitchell observed that the service of the 17 employees and the Chairman aggregated 860 years, over 12% of the Company's employees with more than 40 years' service each, a truly remarkable record. The Chairman of the Company recalled names familiar to him 60 years ago. There were several instances where those present had followed their fathers in the employ of the Company. Mr. Stallard, referring to Mr. S. Richardson, who had 59 years' service, remarked that this was not exactly continuous service, as he had some years ago been retired on pension, but after a retirement covering a period of two weeks, he asked to be allowed to return to work. The Chairman handed to each of the old employees an envelope containing a sum of money on behalf of the Directors.

The Application of Arkon instruments in the control of gas-works operations is the subject of an informative monograph which has just been issued by Walker, Crosweller & Company, Ltd., Cheltenham. Written by Dr. J. S. G. Thomas in collaboration with the manufacturers, it gives a comprehensive review of the points at which instruments should be installed in a typical gas-works plant, and indicates the benefits that may be anticipated from such installation. Opening with a diagrammatic layout of a works with vertical and horizontal retorts, external producers, water gas plant, and coke ovens as the gas-making installations, it explains in detail the functions of the various instruments in retort house control, waste gas flues, foul mains, purification, and the control of gas flow. Complete instrumentation, it is claimed, can be achieved by installing pressure and vacuum recorders, gas flow recorders, full scale gauges, thermometers, and liquid flow recorders in appropriate positions, with the addition of one or more reliable gas calorimeters at various points of the plant, enabling control to be exercised over the entire operations in an effective and efficient manner.



The kitchen of one of two large canteens equipped by Radiation Limited for a works in Northern Ireland. The capacity of each canteen was required to be not less than 600 meals per day, and this has been exceeded in actual use.

PURIFICATION*

By H. B. AVERY

ALTHOUGH it is not possible to obtain an accurate figure for the world's production of town gas which is purified by means of iron hydrate in various forms there can be little doubt that the percentage so purified exceeds ninety—that is to say, that since oxide of iron replaced lime for the purification of coal gas the process has not been seriously challenged.

The removal of sulphuretted hydrogen from town gas is not a pleasant process. It is, on the other hand, essential, and, with oxide, remarkably efficient, and, as pointed out in a recent Paper read in Manchester by C. Cooper ("JOURNAL" of Feb. 2), the sulphuretted hydrogen content is reduced below the statutory requirements. In normal circumstances the operation proceeds so smoothly that it can be almost ignored, and in any case it is frequently regarded as an isolated process unaffected by the other operations in gas manufacture. This view is dangerous, as the difficulties, fortunately only seldom encountered, arising in the purifiers are very often the result of inaccurate control of prior operations. It is therefore unfair to regard purification as a subject which can be dealt with by itself. It must be looked upon as intimately connected with all stages of the production of gas.

For these reasons it seems that consideration of purification would naturally fall into three main sections. In the first we should consider the product to be purified, in the second the apparatus to be used, and in the third the purification material.

The gases to be purified may be either coal gas, coke oven gas, blue or carburetted water gas, or producer gas. Of these, coal gas is the one most to be considered, although in latter years the purification of coke oven gas has become increasingly important.

Coal gas, produced either in horizontal or vertical retorts, and coke oven gas may be considered together, although, as will be pointed out later, in the case of coke oven gas the absence of ammonia requires special consideration.

Variations in the quality of the coal influence the subsequent dry purification operation, mainly through the effect on the sulphuretted hydrogen content of the gas. Purification is also influenced by other factors, for instance the ammonia content, which depends on the washing methods employed. The sulphuretted hydrogen content of the gas at the box inlet may be as low as 100 grains per 100 cu.ft., or as high as 1,000 grains, so that the purifiers at different stations are called upon to face very different loads. In the case of ordinary coal gas from either vertical or horizontal carbonization the sulphuretted hydrogen content varies between 400 and 600 grains under normal conditions. An exceptionally good English coal produces gas containing between 100 and 120 grains in a coke oven plant. On the other hand, many coke oven plants are producing gas containing approximately 800 grains of sulphuretted hydrogen. A great deal of the variation in the sulphuretted hydrogen content of the gas reaching the boxes is due to large variations in the amount extracted during the wet purification process, and this point is also dealt with at some length in the Paper by Cooper (*loc. cit.*).

The hydrocyanic acid content of the gas must be considered in conjunction with the sulphuretted hydrogen content. It is a very variable figure at the box inlet, and this variation is also caused by the washing methods employed. Generally speaking, the quantity present in crude gas is in the neighbourhood of 60 to 70 grains per 100 cu.ft. Of this amount the quantity passing forward with the gas into the purifiers varies from practically *nil* up to 50 grains. In the purifiers themselves, when moderately alkaline conditions prevail and no excess of oxygen is present, most of this hydrocyanic acid is absorbed in the oxide, mainly in the form of ferrous ferrocyanide, to a very small extent as ammonium cyanide and to a very varying degree as ammonium sulphocyanide. When acidic conditions prevail an appreciable amount may pass forward through the purifiers in an unchanged condition. Isolated cases have been encountered where as much as 20 grains per 100 cu.ft. of hydrocyanic acid passed forward into the holder. When the quantity of cyanogen compounds in the oxide is low, most of the hydrocyanic acid is found to have been fixed in the liquor in the form of ammonium sulphocyanide. This always happens to some extent, but to an ever-increasing degree with increasing oxygen content of the gas prior to the washing, or with the heavy circulation of the liquor under oxidizing conditions. In both cases appreciable percentages of ammonium polysulphide are formed, this polysulphide acting as a most efficient scrubbing medium for the hydrocyanic acid.

A further constituent which varies very considerably is ammonia. Where the condensing or scrubbing plant is defective or inadequate and the reduction of the ammonia content of the gas correspondingly difficult, complications may arise through an excessive quantity passing forward to the purifiers. Coke oven gas, on the other hand, being more thoroughly scrubbed for the removal and recovery of ammonia, may be deficient in the amount necessary for purification. It has been established that both excess and deficiency of ammonia are detrimental to the good working of the oxide purifiers, and it is of vital importance that the quantity passing forward should be under control. Examination of spent oxides shows that the ammonia content of the oxide varies from 1% to 7%, expressed as ammonium sulphate. The ideal quantity is 2%, representing about 5 grains of ammonia per 100 cu.ft. in the inlet gas, and this ammonia content appears necessary to maintain neutral working conditions until the oxide is fairly completely spent. Deficiency causes acidity due to the excessive formation of ferrous or ferric sulphates, particularly if a high percentage of oxygen is present. An excessive quantity of ammonia, on the other hand, also results in an acidic condition, due to the formation of ammonium sulphocyanide in excess, and the subsequent reaction of this with ferrous sulphide to form ferrous and ferric sulphocyanides. The effects of ammonia are particularly stressed on account of the fact that trouble-free purification depends so largely not only on the purifiers themselves, but also on the condensing and washing plants and their efficiency. Ammonia in excess can also be the cause of other difficulties arising in purification. The phenomenon of foul gas being evolved from a box in, say, the third taker position when clean gas is entering this particular box is not infrequent, and in most cases this is due to excessive ammonia, and may be caused by the reaction of the ammonia with carbon disulphide, particularly where the temperature is high, or by the reaction between ferrous sulphide and ammonium sulphocyanide.

It is not too much to say that the majority of purification difficulties can be traced to the ammonia content and to the oxygen content of the gas. The oxygen itself may vary from 0.5% to as high as 3% by volume. Most crude coal gas contains a minimum of 0.4% of oxygen, and it is usually accepted that at this percentage little or no oxidation of iron sulphides takes place owing to the extreme dilution of the oxidation effect. For revivification of the oxide in the boxes, oxygen, in the form of air, is usually introduced, and the amount necessary for oxidation of the sulphuretted hydrogen is approximately 0.5% by volume in normal town gas containing 400 to 600 grains of sulphuretted hydrogen. If normal oxidation is taking place in the boxes the minimum concentration at the inlet should be 0.9%, giving an exit figure of 0.4%. Unfortunately, a certain amount of oxygen is always absorbed in the formation of sulphates of iron, and it is therefore necessary in order to obtain full oxidation to add somewhat more than 0.5%. Under normal conditions 1.1% of oxygen at the box inlet is a reasonable figure. With less than this amount frequent discharging of the oxide for external revivification is necessary. With excess, while much handling may be avoided, there is always the attendant risk of excessive formation of sulphates and the development of acidic conditions. Where such acidity does develop the activity of the oxide is diminished and the working of the box impaired. An excessive addition of air is also objectionable owing to the reduction of calorific value.

The temperature of the gas at the inlet to the purifiers may be considered at this point, as it has some effect on the average temperature at which the oxide operates, and there is no doubt that if the temperature at the box inlet is slightly above atmospheric, then greater activity will be shown in the first taker. It should be emphasized, however, that the gas should be saturated with moisture, as otherwise rapid drying of the oxide may occur, and this will render temperature control difficult.

The foregoing remarks deal with coal gas and coke oven gas. When the purification of water gas or producer gas is under consideration the conditions are different, as neither ammonia nor hydrocyanic acid is present to any appreciable extent. The sulphuretted hydrogen content is low, and it is therefore difficult to maintain good working temperatures. This latter point is important when water gas is purified separately. There is no doubt that the addition of a small amount of ammonia is of as much advantage in the case of water gas as in the case of coke oven gas. Producer gas, when used, is generally purified together with coal gas, and although the separate purification of producer gas is not of great interest to the gas engineer, increasingly large quantities are being purified by industrial undertakings, and some very interesting research has been carried out by Dr. Quarendon.

The chief impurity in the case of carburetted water gas is tar, and as the problem of tar contamination of the oxide is common to both water gas and coal gas it should be briefly considered at this point. There is no doubt that the maximum reduction in the amount of tar passing forward to the purifiers in either coal gas or water gas is desirable, and although several methods are available for its reduction, the most efficient remains electrical precipitation. All the evidence available indicates that if the whole of the tar were removed and the gas entered the box at a given temperature, entirely free of solid tar,

* Paper to the Scottish Junior Gas Association.

some small amount of tarry bodies would still be found in the oxide, due largely to condensation and polymerization of gaseous unsaturated hydrocarbons and also to their combination with sulphur. It is difficult to justify the erection of an electrical precipitator immediately before the boxes for the removal of the tar normally passing forward, and as the main object of tar precipitators is to increase the efficiency of the washing plant they are generally installed at the inlet of the washers—that is to say, at a point where the temperature of the gas is slightly higher than at the purifier inlet, so that even if the efficiency of the precipitators is as high as 100%, it is still possible for some small quantity of tar to condense later from the gas and be carried forward in solid form to the purifiers. Spent oxides derived from coke oven plants generally contain the lowest tar content of any, and this can be attributed to the intensive oil washing, which has the further effect of reducing the gaseous hydrocarbons and the naphthalene.

It is hoped that the connexion between purification and the previous processes will be clear from the foregoing review, and we now pass on to the consideration of the purifiers themselves.

During the whole of the time in which oxide of iron has been used in various forms for the purification of gas, it is only in latter years that any appreciable effort has been made to introduce major modifications in the design of the boxes. The old form of purifier consisting of a rectangular container, shallow in depth as compared with its cross-sectional area, is still the most widely employed, and this cannot be looked upon as entirely due to the fact that the old type of purifier when once erected would last for 30 or 40 years, because many modern plants are of this type. These boxes may be elevated, placed on the ground, or wholly or partly sunken into the ground. In the last twenty years various alterations have been made, and these may be briefly enumerated here. First there are tower purifiers. This type was developed by Dr. Lenze at the Thyssensche Gas und Wasserwerke. One plant of this type has already been erected in London by Messrs. W. C. Holmes & Company, Ltd., and as this form of apparatus has been fully described elsewhere, it is not necessary at this point to go into any further details. Secondly, a process known as the Raffloer process was brought out, in which the oxide was made into the form of small pebbles of about ½ in. diameter, with the addition of lightening material and a binding agent, and these were passed downwards through a tower in which the gas passed in an upward direction. The oxide was withdrawn at the bottom and a corresponding amount of new material introduced at the top at regular intervals. As far as is known this process has made no headway. As one of the objects of the process was to extract the sulphur by means of a solvent from the spent pebbles and again return them to the purification unit, the dependence on sulphur extraction and the difficulties which would arise in this latter part of the operation probably accounts for the lack of progress made. We know from our own experience that solvent extraction of spent oxides does not produce a satisfactory purification material without further treatment.

Various attempts have been made to overcome one of the main difficulties of purification, that is the discharging of the boxes by the use of some continuous operation, of which that by Raffloer was an early attempt. Dr. Treckner, of the Ruhr Gas, was making experiments shortly before the war with a rotary purifier, in which the oxide was showered through the gas in different compartments, the oxide passing in counter-current to the flow of gas. No details of this development have been available.

Many years ago McDougal, of Manchester, suggested the use of a form of apparatus in which the oxide was moved from one circular shelf to another by means of rotating arms and blades against a gas stream flowing upwards, the apparatus being similar to the well-known Herrishoff spent oxide burner. As the success of purification depends upon contact between the gas and a solid, the only advantage in continuous feeding and removing of the oxide from the apparatus is that it avoids the intermittent and somewhat laborious operation of discharging from the static purifier. On the other hand, the cost of continuously moving the oxide is high and, in the writer's opinion, unnecessary.

The only modern modification of the old type of box which can be regarded as in any way competitive is that in which the depth of the structure is increased, using multiple layers of oxide and dividing the gas inlet into multiple streams. This type of purifier has been very popular on the Continent for some considerable time, and is now being introduced more frequently into Great Britain. In its favour it can be said that considerable ground space is saved—in itself very often a point of great consideration. The cost of foundations is generally lower, shorter lengths of main are required and a lesser number of valves. Constructional costs can further be lessened, and this type of box is particularly suited for welding and rapid erection. On the other hand, a very serious disadvantage lies in the fact that much more time is taken to discharge the box, and secondly, a large proportion of the purifying capacity is off-line for a considerable period. Greater care must also be taken in filling the boxes, in using grids in good condition, and making sure that the levelling in each layer is the same throughout the box, as otherwise preferential flow will take place, resulting in some layers being far more fouled than others.

With regard to the materials used in the construction of the boxes, these are limited to three—namely, cast iron, steel plate, or reinforced concrete. Cast iron is the material most commonly used, and in spite of high initial cost is preferable on account of its great lasting properties. Steel is used in the construction of tower purifiers, and in most of the deeper boxes which have been introduced. It has the advantage of lightness combined with strength, and although more liable to corrosion than cast iron, can be very easily repaired by patching or welding. Reinforced concrete boxes are now coming into more general use. One particular benefit of this form is that heat losses are very much lower, and in a colder climate better working temperatures in the boxes can be maintained. Heat conservation is such that in some districts liable to extreme summer heat such high temperatures may be reached that water sprays have to be used on the covers to keep the working temperature normal. This question of radiation of heat from the boxes is a very important factor in purification, as it controls the working temperature of the oxide.

The optimum temperature for purification is about 90°F., this temperature being measured in the gas stream and not in the oxide. High temperature has been proved to facilitate oxidation, which is more difficult to promote than sulphiding. In order, therefore, to obtain the best use of the minimum amount of oxygen, as well as to maintain the oxide in an active condition, temperatures should be high. The amount of heat generated by the reaction between coal gas of a normal sulphur content and oxide of iron is far more than is necessary to give such temperatures, but owing to the very low specific heat of the gas most of the heat generated is not carried forward from one box to another but is radiated from the box, particularly when this is in an exposed position. Generally speaking, artificial heating of the oxide is unnecessary in view of the large amount of heat released by the reactions, so that if control can be exercised over the radiation losses no difficulty will be experienced in maintaining the correct working temperature. The question as to whether the purifiers are elevated, at ground level, or below ground level, therefore, is of considerable importance. Elevated cast iron or steel boxes are simple to discharge, but have the serious disadvantage of becoming too cold. Radiation loss is reduced when boxes are placed at ground level, and further reduced when they are partly sunken in the ground or housed in a building. Sunken or half sunken sets are very often placed in the open, in which case radiation from the covers can still reduce the working temperature below the desired level. In such cases the application of insulating material to the covers has a very noticeable effect, particularly if the gangways between the covers are also insulated. On those parts of the Continent where very severe cold is experienced, the boxes are generally housed in a substantial brick building, with only the covers projecting through the roof of reinforced concrete. These covers are themselves insulated with a thick layer of bituminized cork or similar material, and as single covers are generally used for each box no wear and tear of this covering is experienced. Where several covers are used these may have to be lifted and placed on other covers, and wear may take place to a rather great extent. For most of the conditions met with in Great Britain sufficient insulating effect can be achieved by the introduction of a false ceiling inside the cover made of tongued and grooved boarding, which may be reinforced by a layer of felt or similar insulating material.

We come now to what is perhaps the most important consideration—namely, the capacity of the boxes. Many formulae exist for the determination of this factor; some are based on the area of surface exposed to the gas, others on the total quantity of oxide exposed to the flow of the gas. In the writer's opinion the only correct way of establishing a standard is to consider the matter on the basis of time-contact—that is, that the rate of flow through a given quantity of oxide in one box only should be considered. Modern design allows one cubic foot of oxide for every 30 cu.ft. of gas passing through one box per hour. The quantity of gas passed is sometimes in excess of this figure, but is more often well below and in some cases very much lower. Most modern purifier sets consist of 4, 5, or 6 boxes of such a size that the time-contact figure is 30, and all boxes are worked in rotation. The practice of using catch boxes is to be deprecated, and it is usually found that where a catch box is in use and through which the gas is always passing the temperature of this box is generally low, and the oxide tends to become sodden with water and lose its activity. Therefore, when it is intermittently called upon to purify the gas from small traces of sulphuretted hydrogen, it is in no condition to do so and fails to perform its intended function. If this box were rotated in turn with the others it would be kept in an active condition and would perform useful work.

Gas may be passed through the oxide in either upward or downward direction, or in the case of multiple layers divided flow, in which the gas passes in either or both directions, can be used. Generally speaking, downward flow is much to be preferred, as when a rise in back-pressure is first noticed this is probably due to either tar or water arrested when the gas first meets the oxide. Where this layer is accessible by merely lifting the covers the resistant layer can be broken by forking over the surface of the oxide and working continued. On the other hand, if the contaminated oxide is immediately above the bottom grids, the whole contents of the box have to be discharged. A similar difficulty may occur in the case of divided flow, where only the top layer can be treated in this manner.

One of the most important considerations in the working of purifiers is the rotation system employed. It has been mentioned earlier that temperature plays an important part in the absorption of oxygen by the iron sulphides. This fact provides a strong argument in favour of backward rotation, in which the oxide is moved in relation to the gas stream from first through second, third and fourth taker positions.

(To be continued)

LIQUID FUELS AND ORGANIC CHEMICALS FROM COAL AND PETROLEUM

The following discussion took place at the meeting of the Institute of Fuel at which the Paper on "Liquid Fuels and Organic Chemicals from Coal and Home Refined Petroleum" was given by Mr. Harold Moore—see "JOURNAL" of Feb. 2 and 9.

Dr. **E. W. Smith,** C.B.E. (President, Institute of Fuel), said that what the Paper meant was that, first of all, petrol and oil products were necessary for the future development of this country. Having accepted that, it was accepted that the limit to which they could go in getting oil from coal was the extent to which it could be done economically. In carbonization, the limit was set by the demands for gas and coke. If these demands could be extended by legislation for reducing the smoke nuisance, for instance, that would increase the amount of coal carbonized. The Paper also indicated that from the point of view of economics, there was no justification either for hydrogenation or the Fischer Tropsch process, but that there was every justification for developing both processes on a large scale because there might come a time when the amount of oil that was available at present prices might not be as great as it was to-day. Therefore, everybody must be in favour of carrying on research not only in the laboratory, but on a large scale as it was being done at Billingham, to the limit in connexion with hydrogenation and the Fischer Tropsch process.

When it came to the Gas Industry, he could not help feeling that there was a misconception as to the possibilities of these new processes of high pressure and synthesis of CO and hydrogen. There was an exaggerated idea as to the possibilities of these processes for immediate use in the Gas Industry. One had only to think of the complications and economics and efficiencies of even the best of such processes to know that it was not practicable to think of any economic industry being developed to compare with present methods—and present methods were by no means perfect. There were many opportunities of developing and improving the methods of carbonization which were practised to-day.

The Gas Industry had not the control of the tar industry, and he had always thought that to be a mistake. It was true that there were joint tar schemes, but the most optimistic would never suggest that the Gas Industry, with the exception of one or two very large undertakings like the Gas Light and Coke Company, the South Metropolitan Gas Company, the Glasgow Corporation, and a few others, ever had very much to say in,or very much contribution to make towards, the technical development of the tar industry. The tar industry had within the limits which had been set it of small scale working done very well, and in recent years—particularly during the war—it had considerably improved, but he very strongly supported Mr. Moore in his view that there was a great deal to be learned from the petroleum industry by the tar industry, and it was to be hoped there would be further contacts between them.

The chief lesson which he drew from the Paper was that in all countries the most profitable enterprises were not necessarily those that had valuable raw materials, but they were those countries that had such raw materials as enabled them to make valuable finished products, the value being in proportion to the amount of labour spent on the production of these finished products. It was well known that Australia was held back for many years because she was discouraged from doing any more than growing wool and exporting minerals, but as soon as Australia was encouraged to use these raw materials itself within her own boundaries, and to develop secondary industries, she began to go ahead and wanted a bigger population. Therefore, the lesson to be learned from the Paper was that they could afford to buy cheap crude petroleum, because it would enable them to develop limitless secondary products and industries which would provide the rest of this side of the world with these products and, at the same time, provide work here.

Dr. **A. Parker** (Director of Fuel Research) said the Paper had covered an extraordinarily wide field, and had indicated all the possibilities and sources of oil for this country and the use that could be made of them. Although the Paper did not cover all the possibilities, it showed the complexities of the subject, and the question was how were they going to balance all the possibilities one against the other in the best interests of the country? The answer was that they must not be slow to learn something about possibilities of development which were of immediate commercial use and could be made to pay. This included the importation of crude oil, cracking or refining here with the production of chemicals from the various gaseous and liquid products from cracking and from catalytic cracking processes. Some of these processes, as the Author had said, particularly those relating to coal—hydrogenation and Fischer Tropsch—were not, at the moment, commercial propositions. Some form of protection or tariff or duty would be necessary. Nevertheless, he agreed with the Author that that was no reason why they should not work these processes on a sufficient scale to acquire the knowledge and experience which was necessary if at any time they were compelled, for security or other reasons, to expand them rapidly and develop them on a very much larger scale. The hydrogenation process had already been operated on a large scale. On the other hand, they had been extraordinarily slow to develop the Fischer Tropsch process. There had been some experimental work in the laboratory on a small scale at the Fuel Research Station, and he believed that was the only experimental work in this country. No full scale plant had been put up. In his view, a stage had been reached when they ought to have a number of full scale units—not necessarily full scale commercial units—to gain experience. Not only would they thus gain more experience of the process on its technical side, but they would be developing a personnel with experience, which was really vital, for in this country they suffered from a lack of a sufficient number of people not only with scientific training, but with training on the chemical engineering side in the more difficult processes, and the construction of such plants would be worth it even from that point of view. They had lagged behind, and it would take them a little time to catch up with Germany in regard to such a process as the Fischer Tropsch, but they must catch up if they were to forge ahead. The same thing applied to oil refining and the production of many chemicals.

In regard to the development of special oils for internal combustion engines, it was only in recent years that they had talked of 80, 90, and 100 octane spirit which enabled the use of higher compression ratios and led to higher efficiencies. But there would have to be some co-operation between the producers of these high octane spirits and the manufacturers of internal combustion engines, because as the efficiency increased certain problems arose. Valves required special metal, and possibly there would have to be a change of metal for cylinders and pistons and moving parts. There was room for co-operation there, and the position should not be that one industry should provide the engine and another the oil, and do the best they could.

The first essential in all this planning was sound statistical information. For many years the Fuel Research Board had been conducting a survey of the coal resources of this country in relation to quantity, and there had been in the past a certain number of broad guess estimates of how much coal we had in reserve and how long it would last. Recently, because the information was wanted quickly, there had been started a survey of the quantities of coals of different qualities. In the first place, the coals would probably be divided into 8, 9, or 10 different qualities, with estimates of the seams in each coalfield all over the country. It would then be possible to say that certain coals of special quality must not be used for purposes for which other more plentiful coals were equally suitable or nearly as suitable. That idea fitted into the sort of idea the Author had. Whether it was desirable to go as far as the Author had in some respects, he was not sure—but that was a political point. His own view was that with too much planning, difficulties were encountered; it was necessary to look further ahead and take more risks and show more initiative. It was lack of initiative on their part in the past which enabled the Germans to import so much tar from this country and obtain raw materials for the dye industry. Now they had their own dye industry developed, and he agreed there was room for much more research to develop the tar industry in this country, particularly in relation to the available chemicals. There had been a great deal of discussion about chemicals from coal, but it should not be overlooked that by far the larger proportion of coal mined in this country for a long time to come would be primarily for use as a source of power and not as a source of chemicals, and every effort should be made to improve the efficiency of utilization of coal for raising steam.

Dr. **J. G. King** (Director, Gas Research Board) said that perhaps the greatest interest in the Paper was in the Author's review of possible future policy. He had advocated the refining of crude petroleum—a radical change from a pre-war policy apparently advocated by economics. On technical considerations, he had always regretted this state of affairs, particularly when watching the advances in the technique of oil refining which had been taking place during the last few years. Although no doubt there were good reasons why refining should not have been carried out on a large scale in this country, it was regrettable that the policy had deprived us, at least in part, of first-hand experience of the details of the new processes, particularly those involving the control of catalysis on a large scale. The technique of handling catalysts was important in the processes and research of other industries, and a closer approach to the technique of oil refining would be most helpful in the future. He agreed that at least part of the refining should be done here, particularly with the idea of supplying chemical industry with new special products.

As to the contribution which the carbonizing industries could make towards both the fuel and chemical markets, there seemed no doubt that post-war years would stimulate the use of smokeless methods of domestic heating, when the main load might, perhaps, be taken by the fluid forms of heat such as gas and electricity, and solid smokeless fuels would replace coal for open fires and take a large part of the central heating load. This must inevitably mean an increase in the extent to which coal was processed, and whether this was done by complete gasification or not it would mean more benzole and more raw materials for chemicals.

In pressing the case for petroleum refining, the Author had been perhaps a little unfair to the research on tar processing, and to the possibilities which existed of modifying the carbonization processes to produce tar more amenable to, say, cracking, not necessarily hydrogenation cracking, and the possible application of the catalytic processes of the oil industry. He would say to the Author, "Please do not advocate that tar in future must be 'burned' as it is to-day in such large quantities."

The increased production of gas would make available more benzole and more tar, and an accelerated study of the production from these of chemicals was now overdue. The pre-war markets for tar had been sadly disturbed and the time for making plans for the future was now. It was of prime importance that those concerned should thoroughly explore the application of new techniques for tar to provide more lucrative markets than those which existed before and, above all, to avoid the brake which over-production might put on the greater utilization of gas. Benzole was largely a motor fuel at present, but was it not possible that it could be a source of chemicals (ethyl benzene) offering a greater monetary return? Only about half the naphthalene now produced was recovered; surely chemical industry would welcome the products of hydrogenation-cracking of the remainder.

There were also sources of chemicals in the gas. He estimated that the carbonizing industries could provide 200,000 tons of ethylene if a liquefaction process were introduced. Methane could also be made available in the same way for motor fuel, for thermal storage, and to help in the integration of small gas-works. One-third of the methane in town gas was, for example, equivalent to one million tons of petrol.

The Fischer-Tropsch process also had interesting possibilities in terms of the chemical industry, although since over 3 tons of coal were required to produce 1 ton of oil, it was less interesting as a fuel-producing process. He saw no reason why the Gas Industry and the coke oven industry should not combine in exploring the process, operating it in such a way as to stabilize gas production over a geographical area by utilizing off-peak gas and coke.

Finally, complimenting the Author on putting many of these matters so clearly, Dr. King said those concerned with research and development must take heed now of these new processes and possibilities, because now was the time when reconstruction must take place and a move be made towards greater efficiency in production and towards new products and new markets.

The **Chairman** (Mr. E. Shinwell, M.P.) said he had been impressed with the observations of Dr. Parker. When he was at the Mines Department away back in 1924, they were engaged on the geological survey which had been mentioned. They then wished to estimate the precise quantity of coal available for development, and were concerned not only about the physical aspects, but of the potentialities latent in their coal resources for the purpose of chemical development. Yet Dr. Parker, as representing the Fuel Research Board—and this was not a personal criticism—had just stated that his Department was now concerning itself, very hurriedly in an emergency, with this geological survey! Further, when he returned to the Mines Department in 1930, they proceeded to conduct another survey into mineral resources other than coal—copper, lead, and a variety of other minerals—but nothing happened. Why did nothing happen? It was because in all these matters the subject of cost always emerged, as, indeed, it had emerged that afternoon. He begged that these financial considerations should be brushed aside, and his reason for doing so was that, in his view, the test of whether what the Author had put before them was correct—and, what was more important, was available for the purpose of British industry in the future—rested on whether his analysis was capable of creating, not one new industry, but several new industries for this country. Nobody could imagine that after the war this country would be able to rely on its traditions and on its obsolete industrial equipment, for the most part. The Author had directed attention to the need for removing that obsolescence as against such countries as Soviet Russia and the United States with their vast resources. In a sense we were a third-rate economic power unless we were prepared to develop our resources, and develop them out of all recognition. That was the test. It was not the financial test that mattered, and it should not concern us unduly, for this reason: reference had been made to preferences and taxation, but whether an industry was subjected to direct taxation or was the recipient of direct preferences, every industry in the country was affected in one form or another. An industry might not be taxed, and the result might be that its product was placed on the market at a very low price, but it was possible that those employed in that industry were penalized through low wages, with all their reactions on the general standards of living of the community. Therefore, we must brush aside these financial considerations if we were going to rebuild our shattered industries in the post-war period.

As regards research, Dr. Parker had spoken very cautiously, much too cautiously, in his view, for a representative of His Majesty's Government which was charged with the responsibility of conducting a war of colossal magnitude at a very high cost, and without considering the cost. There would be general agreement with what Dr. Parker had said about the need for scientific research, but he had spoken much too cautiously. Dr. Parker had suggested that we might adopt, not full-scale experiments, but partial experiments with the Fischer-Tropsch process, and perhaps further experiments with hydrogenation, but while we fiddled about with research on that scale we should make very little progress. We might as well go back to the old condition of things.

Reference had been made to the need for greater co-operation between the gas and the oil interests. In his view there should be greater co-operation between the gas, oil, and electricity industries, as well as with the coal industry, but he failed to see how the desirable co-ordination could be effected without Governmental action. There should be initiative and inventive and private enterprise, but with State direction in matters of the kind that had been discussed. In saying this, he excluded State ownership, but there must be State direction unless the private interests concerned were so active as to make it unnecessary for the State to intervene.

Dr. **Elvet Lewis** said the Paper advocated an increase in the amount of coal carbonized, thereby adding to the amount of home-produced spirit. The increased use of gas and coke would require the prohibition of the use of raw coal, but before this could be accomplished there was need for considerable research into the methods of producing coke, for the domestic grate and boiler, with a much higher bulk density than was produced at gas-works or by the present low temperature process. The limitation of the use of coal to certain volatile limits, by exercising the power of the Minister of Fuel, must lead to the dislocation of markets, and it would be possible for a colliery to find itself unable to market its coal. The Author had been to some trouble to say that the markets for tar, pitch, and creosote need not be greatly overloaded, but he made no suggestion for dealing with any difficulties which might arise in regard to the economic side of coal production.

Several references were made to restriction by means of taxation, but the misuse of this means of protecting markets must be very carefully guarded against. In a post-war world concerned with the re-establishment of markets at home and overseas, there was a real danger of the erection of tariff barriers which would stifle overseas trade and limit us to dealing largely in the home market. When the balance of trade presented such a problem to this country—and it was likely to be a much more serious problem in, say, ten years after the war—every effort should be made to prevent cut-throat competition such as occurred after the last war, and resulted in wholesale subsidizing and chaos in the world markets. He would not agree to any increase in the tariff system except where changes were necessary, such as to bring the refining industry into line with other industries.

It was stated by the Author that coal products would not be, to any large extent, in competition with oil products. They might not be so at the present moment, except in the case of oil firing, but it was possible to visualize a time when developments in, say, producer-gas driven vehicles would bring coal into direct competition with oil. It was dangerous to assume that future developments in the use of coal would not bring it into competition with oil.

While he was not qualified to discuss the Author's proposals for the petroleum refining industry in their technical aspect, he commented on the statement that "the prices at which commodities should leave the refineries are easy to assess; it is the price of similar products imported and stored for the period necessitated by the distribution system." This would undoubtedly be good business, but very bad economics. What we wanted was a combination of good business and sound economics. The price at which the products should be sold was the lowest possible price, having regard to a suitable return on capital and a reasonable standard of living for the workers in the industry.

The Paper adequately explained what contributions the carbonizing and petroleum refining industries could make to the national economy, but whether these contributions were to be preferred to those that could be made by the other coal utilizing industries should depend on the evolution of a system of organization and control of the coal-producing and utilization industries which would bring about (1) the conservation of our coal resources; (2) the prevention of wasteful and cut-throat competition between the individual utilization industries; (3) the production of energy for the industrial manufacturer at the cheapest possible rate, after having provided for a reasonable return on capital and a decent standard of living for the workers in the fuel industries; and (4) the benefit of the development of new and more efficient processes of utilization, as a result of further research, to accrue to the producing and utilization industries as a whole and not to any one industry. Any scheme formulated on the basis of the Author's suggestions must, if it were to be successful in the national economy, provide for close co-operation between the fuel industries. The ideas put forward in the Paper should be considered in conjunction with other suggestions and plans which were being put forward at the present time.

Mr. **Vivian Davies** strongly supported the Author's argument that marketing had a great effect on production. The selling might be very clever, but it was often wasteful in the extreme. As to the comments in the Paper concerning the backwardness of the tar-refining industry in this country as compared with petroleum refining, especially as regards equipment, British equipment manufacturers were a long way behind the Americans, but he understood that they had got together and were tackling the problem and were trying to make up leeway. The suggestion to link up the use of gas from refineries with gas-works practice was an interesting one. It had been done quite successfully in other parts of the world, and there should be a big field for it in this country.

Mr. **Moore** briefly replied to the points raised.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

FUEL AND METALLURGICAL FURNACES*

By R. WHITFIELD, M.I.S.I., M.Inst.Met.

(*Continued from p. 189*)

Two important points affecting decarburization are not always realized. These are that:

(1) Clean surfaces are more likely to be decarburized.

(2) Stressed clean surfaces are still more liable to decarburization.

It will be noted above that more attention has been paid to decarburization; this is because the damage done to steel by this means is more serious. It is wise to realize that carburization cannot take place effectively *below* the upper critical limits. The working area for carburizing is *above* those lines. A balanced furnace pressure is also beneficial; if the furnace is under suction, ingoing air upsets any existing balance, quite apart from increasing the nitrogen and oxygen content. A "wet furnace" will also cause decarburization due to the water vapour present.

In general, a slightly oxidizing atmosphere gives the best practical results in the heat treatment of steel.

Natural Atmosphere from Combustion of Producer Gas

Producer gas gives, in general, better results than town gas, and is more controllable. The following comparison is helpful:

Town Gas.	Producer Gas.
H_2 in excess of CO	CO is in excess of H_2. Combustion begins much earlier.
High air/gas ratio, 5/1 approx.	Low air/gas ratio, 1-1½/1.
H_2O in products about 20%	H_2O in products about 10%.
CO_2 about 9%. High nitrogen content ...	CO_2 about 15%. Low nitrogen content.
Hard flame	Soft flame.

The flame characteristics have to be seen and contrasted to appreciate the terms "hard" and "soft."

The percentage composition of producer gas can be very varied, without, however, upsetting the points made on the above comparison.

Consider now an average producer gas with the following composition:

Carbon monoxide	CO	24%
Hydrogen	H_2	14%
Methane	CH_4	3%
Carbon dioxide	CO_2	4%
Nitrogen	N_2	55%

Taking the products of combustion resulting from the use of different proportions of air we have:

TABLE VI.—PER CENT. BY VOLUME.

Air ratio.	Air/gas.	CH_4.	H_2.	CO.	CO_2.	N_2.	H_2O.
— ...	—	3	14	24	4	55	—
0.24 ...	0.3	1.5	11	18.26	8.25	58.75	4.2
0.40 ...	0.5	1.34	8.2	11.4	10	62.6	6.0
0.56 ...	0.7	1.1	5.25	6.3	12.5	65	7.2
0.72 ...	0.9	0.6	2.7	2.7	14.25	67.7	8.2
0.88 ...	1.1	0.4	1.04	0.4	15	71.9	9.25
1.00 ...	1.25	—	—	—	15.1	75.2	10.0

The following table has been made up with proportions of air gas, ¼, ½, ¾, and 1 to complete the comparison.

TABLE VII.

Combustion propn.	Gas.	Air/gas.	CH_4.	H_2.	CO.	CO_2.	N_2.	H_2O.	C_2H_4.
0	Town gas	0.00	27.0	48.0	10.5	0.5	11.0	0.0	3.0
	Prod. gas	0.00	3.0	14.0	24.0	4.0	55.0	0.0	0.0
¼	Town gas	1.15	9.6	18.7	7.8	4.2	48.0	14.1	1.05
	Prod. gas	0.31	1.5	10.9	17.8	8.5	58.75	4.34	0.0
½	Town gas	2.3	3.8	8.8	5.1	6.5	62.0	17.5	0.4
	Prod. gas	0.62	1.1	6.6	8.2	11.4	63.0	6.74	0.0
¾	Town gas	3.45	1.3	4.1	2.64	7.8	67.5	18.7	0.2
	Prod. gas	0.93	0.6	2.54	2.2	14.35	68.5	8.4	0.0
1	Town gas	4.6	0.0	0.0	0.0	8.25	71.6	20.2	0.0
	Prod. gas	1.25	0.0	0.0	0.0	15.1	75.2	9.7	0.0

The following practical points can be inferred from the table relative to the use of producer-gas and have been verified in practice:

(1) It is better from an "atmosphere" point of view.

(2) The "atmosphere" from incomplete combustion has less damaging effects.

(3) Decarburization is much slower with highly reducing atmospheres than with town gas.

(4) When combustion starts with producer gas, the proportion of CO is much higher than the proportion of H_2; this condition cannot exist with a typical town gas at any stage.

(5) We cannot be quite free of the possibility of decarburization because hydrogen and water vapour are present.

(6) The best atmosphere, metallurgically, but not economically, is air/gas=0.75. It is practically neutral for oxidation, and is negligibly decarburizing for average heating times, because CO exceeds H_2 and CH_4 is present, which tends to carburize.

(7) With an air/gas ratio=1, decarburization is slow, and oxidation very slight.

(8) It is more efficient from the fuel aspect.

* From a Paper to the Institute of Fuel.

In general terms, producer gas is more efficient than town gas because of its wider range of application; but the possibility of decarburization occurring is always present, and may be serious on long period heat treatments at forging temperatures.

Furnaces fired by town gas, producer gas, or oil have many advantages over solid-fuel furnaces. Some are as follows:

(1) Less air is needed for complete combustion.

(2) More uniform working temperatures are possible.

(3) Temperature can be automatically controlled.

(4) Less liable to variation of conditions.

(5) The atmosphere is partially controllable; although the possibility of oxidation and/or decarburization is always present. (A so-called "reducing" atmosphere is not practical on an oil-fired furnace.)

(6) It is easier to control furnace pressures.

(7) No labour is necessary to supply fuel, or to dispose of the ash.

(8) Easy to light up, and can be turned out when they are no longer required. This is particularly advantageous when a furnace is used only by a day shift.

(9) Reasonably constant composition of the fuel, especially so with town gas.

The proportion of hydrogen is a very important factor; with town gas its effect is very pronounced, but less so with producer gas; with coal-fired furnaces it is negligible. But owing to the excess air required to effect satisfactory combustion oxidation is almost inevitable, and decarburization is prevented by the formation of scale, especially at the lower temperatures usually met with in heat treatment work. At higher temperatures decarburization is always possible, especially with high-carbon steels.

Taking all the factors into consideration and from the point of view of furnace atmosphere, producer gas appears to be the most advantageous fuel to employ. But the only real way to avoid oxidation and decarburization in steel is to keep the natural products of combustion away from the metal and to provide an artificial atmosphere of the correct composition, then to cool the metal to atmospheric temperature in the same atmosphere.

Furnace Insulation

This is a very important part of the subject, as conditions may arise where insulation, or even superinsulation, may be a distinct disadvantage.

For some operations, a metal must be furnace-cooled at a definite rate. If the insulation is thick, or of a high quality, the cooling rate may not be controllable, and since cooling is, generally speaking, of more importance than heating, a vital part of the treatment is impaired. It is not, as a rule, practical to control cooling by air in metallurgical operations. Cooling has to be effected by controlling heat input against the heat output by radiation and convection.

For very high-temperature furnaces, insulation is of doubtful advantage, because the stability of many standard refractories depends upon such a heat gradient that about two-thirds of the brick is well below the collapsing pressure; adding insulation may reduce the stable area to the point where the arch or wall is rendered unstable.

It is not always realized that insulation does not give equal economies on continuous and intermittent operation. This is due mainly to the amount of heat stored in brick walls. This point is clearly made in the following table, from *Industrial Furnaces*, by Trink, vol. i, p. 155.

TABLE VIII.—REDUCTION OF WALL LOSSES BY INSULATION, %.*

Thickness firebricks.	Continuous operation.		One-week cycle.	One-day 6 days per week.
in.	2½ in.	5 in.	2½ in.	2½ in.
4½	62	76	58	25
9	46	65	36	18
13½	38	57	20	14
18	35	53	15	12

* "One-week cycle" means continuous operation day and night for 135 hours per week. "One-day cycle" means heating 8 to 10 hours each day, shut down overnight, also over Sunday. The conducting area of the insulation is taken to be equal to that of the firebrick wall.

The whole question of intermittent *versus* continuous working is very complicated, but, as mentioned elsewhere, it is only common sense to find that continuous is the more economical. Apart from this, economy may be effected by lengthening the time of the daily run. For the average furnace proportions the savings are approximately as follows:

TABLE IX.

Thickness of firebricks.	Thickness of insulation.	Saving.
in.	in.	%.
4½	2½	15
9	2½	12
13½	2½	10
18	2½	8
13½	5	18

For an economical proposition we have to consider:

(1) Fixed charges on the insulation.

(2) Cost of the fuel.

(3) Thickness of the wall.

(4) Intermittency of operations.

(5) Working temperature within the furnace.

A development over the last three or four years is the use of "hot face" nsulation. Normal insulation must be protected from flame contact and from the furnace temperature by firebrick, as it is generally fragile and may shrink and perish at the working temperature; but "hot face" insulation can withstand temperatures up to 1,300°C., and be subject to reasonable flame contact. Apart from these important advantages, the amount of heat stored in the brickwork is much less; the time required for an internal flash heat is also reduced. (The flash heat state is conditioned by the inner surface reaching 95% of the furnace temperature.) Much, however, depends upon the operator. The use of "hot face" insulation causes a remarkable reduction in the time necessary to reach saturation temperature; it is at least halved.

"Hot face" insulation is fragile, like most other insulating material, and therefore cannot stand the wear and tear of normal furnace processes; these bricks are also apt to spall. It is therefore possible for the cost of frequent repairs to outweigh the savings effected.

Pyrometers

Reliable manufacturers of temperature measuring equipment have in great measure kept pace with the precision heating needed to-day.

In a modern works where a number of pyrometers are in use, an independent and periodical check of their accuracy is essential. The independent instrument should be of the potentiometer type and operated by a skilled technician.

Here are some common faults based upon practical experience. These should be checked before taking up with a manufacturer:

(1) Change in thermocouple calibration: This is particularly important, as the error may not be sufficient to give a noticeable change in the furnace temperature. A change of 10° or 20° may be of considerable importance.

(2) Change in calibration of instrument: Loose connexions, dirty contacts, and short circuiting are common faults which cause this trouble.

(3) Variation in compensating lead resistance: It must not be forgotten that the electrical characteristics of the compensating leads bear a definite relation to those of the thermocouple. The instrument is checked on this assumption. The faults to look for are oxidation of wire, faulty contacts, and temperature variations.

(4) Variations in the temperature of cold junction: The e.m.f. depends on the difference between the two ends of a closed circuit; hence the cold and temperature is very important. This should be included in the periodical examination. Some firms bury the cold junction well below ground so as to be immune from seasonal temperature variations.

(5) Dirty and incomplete contacts.

(6) Faulty sheaths: The thermocouple must not be exposed directly to the heat. There are two main reasons for this:

(*a*) The insulating material separating the wires may get broken.

(*b*) The gases may damage the couple, and the wires forming the couple, by corrosion. Sulphur in particular is damaging to couples of the nickel type.

A nickel-chrome sheath is generally used, but this nevertheless wants watching, especially in an atmosphere containing sulphur. If the sheath becomes porous, or collapses, then the couple is exposed directly to the influence of the furnace atmosphere.

The installation of the essential temperature measuring equipment involves added responsibility and expense, and its effective maintenance is of supreme importance.

Recuperation and Recuperators

A recuperative system, simple or complicated, is embodied in a modern furnace, but very often the size of the recuperator and its capacity is limited by the furnace volume. When high temperatures are required the recuperative system becomes somewhat complicated. A common failing of recuperative systems in modern furnaces is their inaccessibility; and owing to present imperative demands the furnace is kept on until it becomes necessary to rebuild it completely, instead of repairing the recuperator only.

For temperatures up to 1,000°C. combustion is usually initiated and completed outside the furnace chamber proper. Beyond 1,000°C. combustion within the chamber becomes advisable and sometimes necessary. Air-blast burners are used for very high temperatures, but care must be taken to dispose carefully the course of the flame; the action and the air-blast on refractories is damaging. Also the blast must never be directed on to the work, or heavy scaling will be the result. All flame implies that combustion is in progress and free oxygen exists. Higher temperatures demand hot air, and the recuperative system becomes essential. In any case, warm air has advantages. These advantages are:

(1) Higher flame temperatures are possible.
(2) Quicker combustion.
(3) Combustion is more controllable.
(4) Mixing is more efficient, because streamlining is reduced.
(5) Reduction of excess air due to better mixing.
(6) Reduction of unburned gas passing from furnace for the same reason.
(7) Furnace atmosphere tends to be more reliable and controllable.
(8) Better combustion conditions with relatively poor furnace design or conditions.

Preheating gas is sometimes possible, and in very high temperature work gas preheating may be essential, especially for lean gases such as producer gas or blast furnace gas. In open hearth steel melting, using the normal regenerative system, gas and air is preheated to from 800°C. to 1,150°C.; here a temperature of 1,600°C. to 1,700°C. with a partially controllable atmosphere is essential; but in this case hydrocarbon cracking may result in the deposition of carbon, which is apt to be troublesome in the gas regenerators.

There are three principal types of recuperators: (*a*) Counter current; (*b*) parallel flow; and (*c*) right angle flow.

To design recuperators on a mathematical basis is not easy owing to many variable and material factors. For instance, the condition of contacting surfaces is of prime importance, and the thickness and behaviour of the ever-present stagnant layer introduces important uncertainties.

There are two principal methods of reducing this relatively non-conducting stagnant layer:

(1) By means of "core busters"; for example, assuming the recuperator has circular tubes, say 3 in. in diameter, a solid round 2-in. diameter rod is inserted and fixed axially in them; this increases the rate of flow of the gas considerably, and enforces contact with the tube.

(2) By continually breaking up the continuity of flow by projections. Boiler-makers increase efficiency considerably by sinuous or corrugated tubes. The Author is not aware whether sinuous tubes have been used in a recuperator system, but it is certainly worth trying; extra economies will probably outweigh the extra expense involved.

The counter-current type is generally the most efficient as the greatest difference of temperatures between the products and the air then exists; hence the relatively higher transfer rate.

The heating of the air is affected by conduction, convection, and radiation. Calculations involving these factors are difficult, and it is an open question whether they are worth while. Restricted areas alter the relative values of them, and very often furnace engineers have to fit in as efficient a recuperator as space will allow.

The best design from a heat transfer point of view is that in which the flue gases travel slowly and the air quickly through them. This method is best attained in recuperators of metal where speed is dependent on pressure and the gases cannot short-circuit. With refractory recuperators an excessive difference of pressures causes short-circuiting at the joints.

One method of recuperation, however, is to inject a controlled volume of very hot products of combustion into the stream of secondary air. The following advantages have been claimed for this:

(1) Very efficient preheating.

(2) With certain fuels, better combustion is obtained, as it tends to lengthen the flames and the period required for combustion.

It is an open question as to whether recuperation is worth while when furnaces are worked intermittently. There is, of course, a much better opportunity of recuperation being economical when a metal recuperator is used, because of the much quicker response in heat transfer. On continuous furnaces recuperation always pays.

The use of metal recuperators has increased with the ease of obtaining heat-resisting metal of reliable and consistent quality. But it is doubtful whether it is an economical proposition to use metallic recuperators when the furnace temperature is over 1,000°C.

It is not always realized that with metal recuperators the temperature of the metal is approximately the average between the two temperatures. When the furnace is shut off and cold air intended for combustion does not pass through the recuperator, the metal is apt to increase in temperature, because the cooling medium is absent; many failures and much unjustified criticism is due to this fact. Means should be provided to keep the cold air on until the furnace has cooled down, but not at the expense of pumping comparatively cold air into a hot furnace *via* the burners; even the best refractories take very unkindly to this kind of treatment.

There are several heat-resisting coatings that can be applied to ordinary steel. These coatings are usually burnt on and form a skin alloy with the parent metal. For reasonable temperatures (up to 800°C.) they are good, but an important fact is often forgotten—the treated metal wants very careful handling. Wherever the skin is broken and the parent metal exposed, a possible weakness occurs. It is common to see the expensively treated pipe dragged off the lorry, the surface is rubbed off and the parent metal surface exposed; the metallizing expense is then practically wasted.

One of the best means of utilizing waste heat is to preheat the incoming load. The continuous furnace is always an excellent proposition. In addition to the economical use of heat, labour costs and handling difficulties are very much reduced. In general, it is not good to put cold material into a hot furnace; here the continuous furnace gives that gentle increasing heat-rate penetration which is always so beneficial. The initial cost may be relatively high, but the investment is an excellent one, if only from the point of view of labour saving.

The loss of heat from door openings is greater than is often realized, especially with the high temperatures used in forging furnaces. These are of the order of 1,300°C. For practical purposes black body conditions exist. If radiation be taken to be proportional to the fourth power of the absolute temperature at 900°C., the radiation will be 240 B.Th.U./sq.in./hr., whereas at 1,300°C. the radiation will be 780 B.Th.U./sq.in./hr.

THE Radiation Gas and Solid fuel kitchen, which has been on exhibition at Radiation House for several months, is now well known to the Gas Industry as the first practical example of post-war planning, using materials then expected to be available.

Wide publicity was accorded to the design by the Public, Professional and Trade press, a selection of which is given below.

THE ARCHITECT & BUILDING NEWS
ARCHITECTS' JOURNAL
ARCHITECTURAL DESIGN & CONSTRUCTION
ARCHITECTURAL REVIEW
BATH & WILTS CHRONICLE
BIRMINGHAM GAZETTE
BIRMINGHAM POST
THE BUILDER
BUILDERS' MERCHANTS' JOURNAL
BUILDING INDUSTRIES
COKE & SMOKELESS FUEL AGE
COLLIERY ENGINEERING
DAILY MIRROR
GAS JOURNAL
GAS TIMES
GAS WORLD
GOOD HOUSEKEEPING
HEATING & VENTILATING ENGINEER
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THE IRONMONGER
LOCAL GOVERNMENT CHRONICLE
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NATIONAL BUILDER
OFFICIAL ARCHITECT
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GAS PRODUCTS PRICES—STOCKS AND SHARES

The London Market Feb. 14.

All Coal Tar Products are in good demand, and Pitch in the London area remains about 45s.

The new Coal Tar Products Prices Order, 1943 (S. R. & O. 1528), came into force on Nov. 15, fixing the prices at which Coal Tar Oils may be sold for various specified purposes. It also confirms the prices which may be charged for other Coal Tar Products under earlier Orders.

An Order entitled The Control of Toluene (No. 3) Order, 1943 (S. R. & O. 1943, No. 976), came into force on July 20, and introduced certain changes in the prices for different grades of Toluene.

There are no changes to report in the prices of Coal Tar Products.

The Provinces Feb. 14.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 1s. 11d. to 2s. 1d., pure, 2s. 7½d. (controlled by the Control of Toluene No. 3 Order, dated July 14, 1943, operative from July 20, 1943). Naphtha and Xylole controlled by the Coal Tar Naphtha and Xylole Order, 1943, dated May 31 (S. R. & O., 1943, No. 768), operative from June 1. Carbolic acid, 60's, naphthalene, anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.), and strained anthracene oil controlled by the Coal Tar Products Prices Order, 1943, dated Oct. 20, 1943 (S. R. & O. 1943, No. 1528), operative from Nov. 15, 1943.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 2f the "JOURNAL" for Sept. 10, 1941.

Scotland Feb. 12.

Deliveries are proceeding in substantial quantities. Refined tar*: Yield to Distillers is 4½d. per gallon *ex* Works, naked. Creosote oil: Timber preserving quality,* 5½d. to 6½d.; hydrogenation oil,* 5⅞d.; low gravity or virgin oil,† 7¼d. to 7½d.; benzol absorbing oil,* 6½d. to 8d. per gallon. Refined cresylic acid* is 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha†: 6½d. to 7d. per gallon. Solvent naphtha*: Basic prices delivered in bulk, 90/160 grade, 2s. 8d., and 90/190 Heavy naphtha, Unrectified, 1s. 10½d.; Rectified, 2s. 3d. per gallon. Pyridine†: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

* Price controlled. † Uncontrolled.

Most sections of the Stock Exchange were quietly firm during last week. An upward tendency developed in the gilt-edged Market and renewed support was forthcoming for industrial equities.

The Gas Market was more in the news last week on the announcement of the higher dividend by two of the Metropolitan Companies. The Gas Light & Coke Company is paying a final dividend of 2½%, making 4% for the year (against 1% for 1942), and the South Metropolitan Company a dividend of 3% for the year, which also compared with 1% a year ago. The directors of the Commercial Gas Company announce that they are again unable to recommend any dividends on the ordinary or preference stocks.

The volume of business was a little heavier, and apart from a few *ex div.* markings, most of the movements were in an upward direction.

The following is the complete list of price changes during the week:

SUPPLEMENTARY LIST

East Wight Cons.	85—90	+8
Eastbourne "B"	68—73	+6
Plymouth & Stonehouse 5 p.c. Deb.	115—120	+1
Romford 4 p.c. Deb.	97—102	+2

PROVINCIAL EXCHANGES

Newcastle Units (*x.d.*)	24/—24/9	Feb. 7
Ditto 4 p.c. Pref. (*x.d.*)	98—100	"
Sunderland Ord. (*x.d.*)	112—114	"

OFFICIAL LIST

Associated Gas & Water Undertakings Deferred	21/6—22/6	+/-/6d.
Croydon 5 p.c. Deb.	118—123	+1
Gas Light & Coke 3 p.c. Deb.	87—90	+1
Ditto 5 p.c. Red. Deb.	107—110	+1
Imperial Continental	81—84	−2
Portsmouth Cons. (*x.d.*)	121—126	Feb. 7
Severn Valley Ord.	21/9—22/9	+/-/3d.
Ditto 4½ p.c. Cum. Pref.	20/6—21/6	+/-/6d.
South Suburban Ord. (*x.d.*)	111—116	Feb. 7
Ditto 5 p.c. Pref. (*x.d.*)	106—111	"
Ditto 4 p.c. Pref. (*x.d.*)	93—98	"
Ditto 3¾ p.c. Red. Pref. (*x.d.*)	90—95	"
Southampton Ord. (*x.d.*)	95—100	"
Wandsworth Cons.	113—118	+3
Ditto 4 p.c. Pref.	95—100	+1
Watford & St. Albans	113—118	+3

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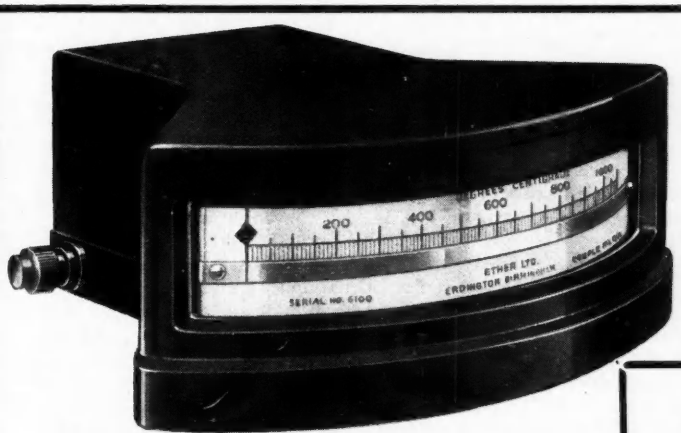

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